me that the velocity of the wave between Galle and Aden was 378 miles an hour, and the lengths of the great waves from 287 to 630 miles.

Postscript, December 15.—Since the above was read before the Royal Society, a copy of the barometric trace from New York has been received, which shows disturbances very similar to those recorded at Toronto, and at times which are quite in accordance with the conclusions stated in the paper.

III. "Experimental Researches on the Electric Discharge with the Chloride of Silver Battery." By Warren De La Rue, M.A., D.C.L., Ph.D., F.R.S., and Hugo W. Müller, Ph.D., F.R.S. Received December 5, 1883.

Second Postscript to Part IV. "Phil. Trans.," Part II, vol. 174.

Striking Distance.

In a postscript to Part IV of our researches,* we stated that, with 14,400 cells, partly of the rod form, partly of the chloride-in-powder form, the length of the spark between paraboloidal points was 0·7 inch (17·8 millims.), and between a point and disk 0·62 inch (15·7 millims.), and that it does not appear, therefore, that the law of the spark being as the square of the number of cells holds good beyond a certain number.

These results were obtained at the Royal Institution; since the removal of the battery to our laboratory we had not, at the date of the postscript to Part IV of our researches, charged up the whole of it. Recently, however, we have put the battery in thorough order, by scraping the zinc rods† of the cells already charged up and added newly made up cells to bring up the total to 15,000 cells, all of the rod form.

Having the whole 15,000 cells in perfect order, we thought that it would be desirable to make fresh determinations of the striking distance, increasing the potential a thousand cells at a time, between two very slightly convex disks (planes), a point and disk, and two paraboloidal points. These points are one-eighth of an inch (3·175 millims.) in diameter, and three-eighths of an inch (9·525 millims.) long. In the case of a point and disk, the point was like one of those used for

* "Phil. Trans.," Part II, vol. 174, p. 725, separate copy p. 249.

† We are at present making experiments in order to prevent the deposit of oxychloride of zinc on the zinc rods by covering the charging fluid with a layer of paraffin oil.

two points, and the disk was $1\frac{5}{16}$ inch [3·334 centims.] in diameter. The two planes used were $1\frac{5}{16}$ inch [3·334 centims.] in diameter.

As the points, particularly the negative, are deformed at each discharge, the precaution was taken to touch up the point after each discharge in the shaping-tool, screwed to the mandril of the lathe, mentioned in Part I of our researches,* and thus to restore it to a true paraboloidal form.

The following results were obtained between:—

Table I.

Two Disks.

Cells.	Striking distance. Inch.	Centim.
12,000	0 ·148	0 ·3759
13,000	0 ·160	0 ·4191
14,000	0 ·181	0 ·4597
15,000	0 ·198	0 ·5029

Table II.

A Point and a Disk.

Cells.	Striking distance. Inch.	Centim.
1,000	0 ·0055	0 ·0140
2,000	0 ·0240	0 ·0610
3,000	0 ·0600	0 ·1524
4,000	0 ·0950	0 ·2413
5,000	0 ·1700	0 ·4318
6,000	0 ·2300	0 ·5842
7,000	0 ·2770	0 ·7039
8,000	0 ·3450	0 ·8762
9,000	0 ·3900	0 ·9906
10,000	0 ·4340	1 ·1023
11,000	0 ·4780	1 ·2141
12,000	0 ·5200	1 ·3208
13,000	0 ·5680	1 ·4427
14,000	0 ·6090	1 ·5468
15,000	0 ·6580	1 ·6713

* "Phil. Trans.," Part I, vol. 169, p. 79, separate copy p. 25.

Table III.

Two Points.

Cells.	Striking distance. Inch.	Centim.
1,000	0·007	0·0178
2,000	0·020	0·0508
3,000	0·052	0·1320
4,000	0·140	0·3555
5,000	0·220	0·5588
6,000	0·273	0·6934
7,000	0·345	0·8762
8,000	0·405	1·0290
9,000	0·480	1·2192
10,000	0·513	1·3030
11,000	0·575	1·4605
12,000	0·614	1·5595
13,000	0·649	1·6490
14,000	0·675	1·7144
15,000	0·740	1·8800

These several results, the different sets being distinguished by plain crosses or crosses with a dot, are laid down on the diagram, Fig. 1, to which are also added other results already published from former experiments; these latter have a ring on one of the members of the cross. The crosses for two disks, up to 11,000 inclusive, are taken from the table in Part III of our researches,* those for the point and disk from Table XI in Part I, p. 84, and the table in the same part, p. 116; those for two points, from Table XIII*a*, Curve XV*a*, p. 86, separate copy p. 32, and the table, p. 118, separate copy p. 64, of Part I of our researches.†

Through the absolute observations, curves were drawn as on the diagram to represent the mean of the experiments in Tables I, II, and III, represented on the diagram by plain crosses (without a ring). From these curves were deduced the numbers given in Tables IV, V, and VI, in C.G.S. units.

* "Phil. Trans.," Part I, vol. 171, p. 241, separate copy p. 177.
† "Phil. Trans.," Part I, vol. 169, separate copy p. 64.

Fig. 1.

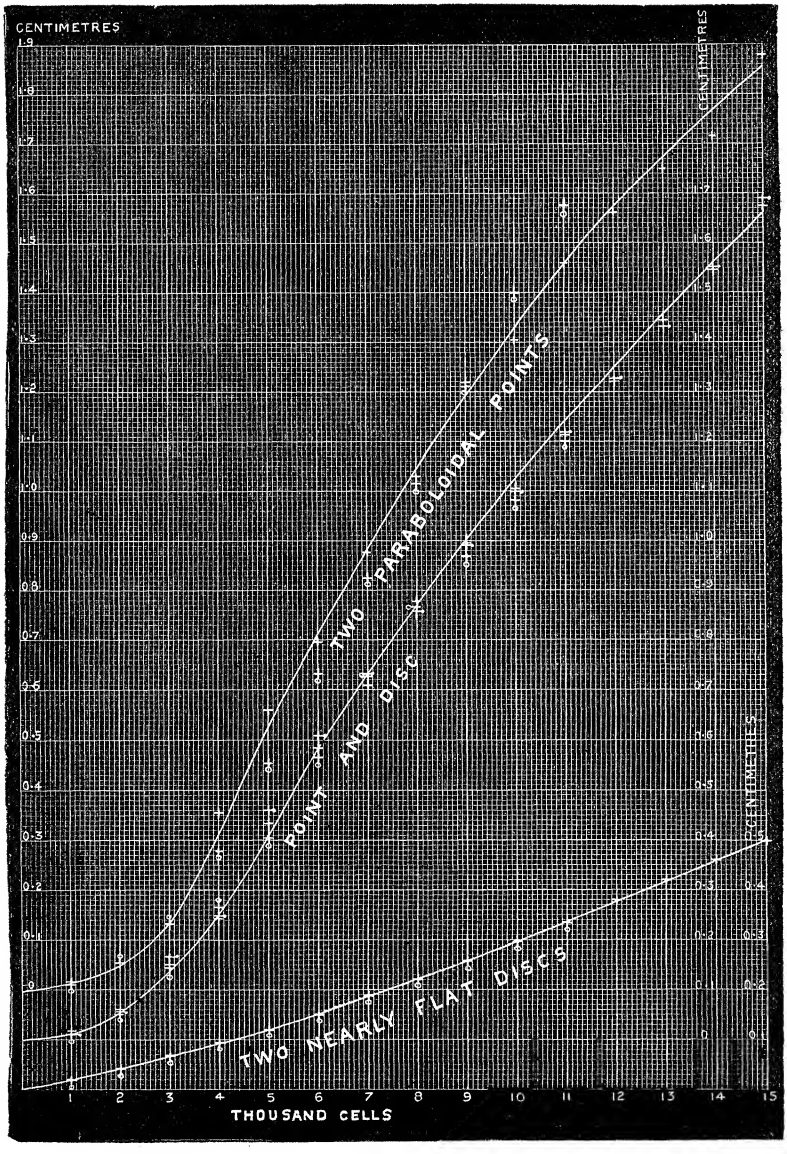
CENTIMETRES
CENTIMETRES
TWO PARABOLOIDAL POINTS
POINT AND DISC
TWO NEARLY FLAT DISCS
CENTIMETRES
THOUSAND CELLS

Table IV.

Two Disks.

E.M.F. in volts.	Striking distance in centimetres.	Difference of potential per centimetre. Volts.	Intensity of force.	
			Electro-magnetic.	Electro-static.
1,000	0·0205	48,770	$4·88 \times 10^{12}$	163
2,000	0·0430	46,500	4·65 ,,	155
3,000	0·0660	45,450	4·55 ,,	152
4,000	0·0914	43,770	4·38 ,,	146
5,000	0·1176	42,510	4·25 ,,	142
6,000	0·1473	40,740	4·07 ,,	136
7,000	0·1800	38,890	3·89 ,,	130
8,000	0·2146	37,280	3·73 ,,	124
9,000	0·2495	36,070	3·61 ,,	120
10,000	0·2863	34,920	3·49 ,,	116
11,000	0·3245	33,900	3·39 ,,	113
12,000	0·3566	33,652	3·37 ,,	112
13,000	0·4068	31,957	3·20 ,,	107
14,000	0·4463	31,369	3·14 ,,	105
15,000	0·4882	30,725	3·07 ,,	102
15,450	0·5029	30,722	3·07 ,,	102

Table V.

A Paraboloidal Point and a Disk.

E.M.F. in volts.	Striking distance in centimetres.	Difference of potential per centimetre. Volts.	Intensity of force.	
			Electro-magnetic.	Electro-static.
1,000	0·0123	81,103	$8·11 \times 10^{12}$	270
2,000	0·0567	35,274	3·53 ,,	118
3,000	0·1379	21,755	2·18 ,,	73
4,000	0·2447	16,347	1·63 ,,	54
5,000	0·4029	12,410	1·24 ,,	41
6,000	0·5631	10,655	1·07 ,,	36
7,000	0·7039	9,945	0·99 ,,	33
8,000	0·8447	9,471	0·95 ,,	32
9,000	0·9709	9,270	0·93 ,,	31
10,000	1·0874	9,196	0·92 ,,	31
11,000	1·1990	9,174	0·92 ,,	31
12,000	1·3058	9,190	0·92 ,,	31
13,000	1·4078	9,234	0·92 ,,	31
14,000	1·5145	9,244	0·92 ,,	31
15,000	1·6116	9,307	0·93 ,,	31
15,450	1·6600	9,307	0·93 ,,	31

Table VI.

Two Paraboloidal Points.

E.M.F. in volts.	Striking distance in centimetres.	Difference of potential per centimetre. Volts.	Intensity of force.	
			Electro-magnetic.	Electro-static.
1,000	0·0173	57,866	$5·79 \times 10^{12}$	193
2,000	0·0493	40,568	4·06 „	135
3,000	0·1282	23,409	2·34 „	78
4,000	0·3078	12,996	1·30 „	43
5,000	0·5107	9,790	0·98 „	33
6,000	0·6845	8,766	0·88 „	29
7,000	0·8496	8,239	0·82 „	27
8,000	1·0117	7,908	0·79 „	26
9,000	1·1602	7,757	0·78 „	26
10,000	1·2913	7,744	0·77 „	26
11,000	1·3130	7,785	0·78 „	26
12,000	1·5243	7,873	0·79 „	26
13,000	1·6271	7,990	0·80 „	27
14,000	1·7146	8,165	0·82 „	27
15,000	1·7961	8,351	0·84 „	28
15,450	1·8500	8,351	0·84 „	28

An inspection of the diagram, drawn on a reduced scale from the curves as originally laid down, shows that the curve for approximate planes (slightly convex, to ensure the centres being the most prominent) is continuously concave, whereas those for both point and disk and two points are concave only for a certain distance, and then turn off and become convex. Moreover, that the intensity of force per centimetre decreases continuously up to 15,450 volts in the case of planes; but that, in the case of a point and disk, and also in that of two points, the decrease ceases after a certain potential has been reached, and that then it increases so as to become nearly a constant quantity. Between a point and a disk the potential per centimetre at 9,000 volts and beyond is very nearly 9,200; consequently, if the law holds good, to produce a spark 1 décimetre (3·94 inches) long, 92,000 volts, one 1 metre (39·37 inches) long, 920,000 volts,* and a flash of lightning 1 kilometre (0·621 mile) in length, a potential of

* To produce a spark between a point and a disk used for example as the dischargers of an induction coil—

In length.	It would require in E.M.F. volts.
1 inch	23,367
1 foot	280,400
1 yard	841,230

920,000,000 volts would be required, but this potential would be lessened by the diminution of the atmospheric pressure at the height of a kilometre, namely 607·4 millims. (799,210 **M**), or a mean pressure of 713·8 millims. (939,211 **M**) between 1 kilometre and the earth. Taking the mean pressure 939,211 **M**, it would require 864,000,000 volts to produce a discharge between a cloud (regarded as a point) 1 kilometre high and the earth.

It is extremely difficult to conjecture how a cloud can become charged to such an enormous potential, unless the charged molecules balance each other (as those of a stratum in a vacuum tube may be conceived to do) until a disturbing cause breaks up the arrangement; and then the whole of them are discharged in one direction with their aggregate potential.

We may add that less than 15,000 cells would not have sufficed to make out the fact that the intensity of force to produce a discharge between a point and disk or two points becomes a constant after 9,000 to 11,000 cells has been reached.

The following table gives the ratios of the striking distances between a point and a disk and two points respectively, taking those between two disks as unity. And also the relation between the striking distances between a point and a disk and between two points, taking those between a point and a disk as unity.

Cells.	Ratio between point and disk to that between two disks.	Ratio between two points and that between two disks.	Ratio between two points and that between a point and disk.
With 1,000	0·60	0·84	1·40
„ 2,000	1·32	1·15	0·87
„ 3,000	2·09	1·94	0·93
„ 4,000	2·68	3·37	1·26
„ 5,000	3·42	4·34	1·27
„ 6,000	3·82	4·65	1·22
„ 7,000	3·91	4·72	1·21
„ 8,000	3·94	4·71	1·20
„ 9,000	3·89	4·65	1·20
„ 10,000	3·80	4·51	1·19
„ 11,000	3·69	4·35	1·18
„ 12,000	3·58	4·18	1·17
„ 13,000	3·46	4·00	1·16
„ 14,000	3·39	3·84	1·13
„ 15,000	3·30	3·68	1·12
			Mean 1·16

The striking distances from which the above ratios are calculated are those obtained from the smoothed curves.

FIG. 1.


CENTIMETRES
TWO PARABOLOIDAL POINTS
POINT AND DISC
TWO NEARLY FLAT DISCS
THOUSAND CELLS